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# The effect of the material based on the 7E model on the fourth grade students' comprehension skill about fraction concepts

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## Abstract

The purpose of this study is to investigate the effect of the material on the fourth grade primary school students' comprehension skill about fraction concept. Quasi-experimental research design including 44 students (22 experimental, 22 control group) were used. While the experimental group was taught with the materials based on the 7E model, the control group was taught with the existing textbook material. An open ended test including ten questions about fraction developed by the researchers and teachers was used as pre and post-test. Pre and post-test results were compared by using t-test in SPSS packet program and it was determined that there was a meaningful difference between experiment and control groups' success ( $t_{42}=2.052$ ,  $p=.046 < .05$ ) about fraction.

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**Keywords:** Fraction; 7E model; constructivist approach; mathematics; primary curriculum.

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## 1. Introduction

Mathematics, which we have been face to face since primary schools, is indispensable part of our daily life and it is a subject to be focused on not only academic information but also general interest. Mathematics is not a common communication language and a strong tool for scientists and engineers only. It is an important tool we use both in science and daily life. Because of this importance, mathematics has been permanent lesson of school program since primary school even if nursery school (Baykul, 1999).

If we teach mathematics with a static way in memorizing facts and rules, mathematics lessons become boring for all students. Besides, the mathematics lessons borders the students' potential and it does not let students to use their different creative abilities. For that reason, most of the students do not attend to mathematics classes willingly, so this decreases the students' success (Lesser, 2000).

One of the most difficult topics of mathematics for the teachers and students is fraction, especially the fractional process. Every year, students learn fraction as addition, subtraction, division, and multiplication in a routine way,

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however; in the following years they probably forget how to do them. The primary reasons of having difficulties to do fraction process are that students memorize the formulas and algorithm instead of understanding them, and also they perceive denominator and shares of the fraction as two different integers (Şiap and Duru, 2004).

To explain the nature of Learning and Teaching process many learning theories are suggested. One of the theories that most defended in recent years is the constructivist learning theory. Constructivism is a theory of knowledge (epistemology) which argues that humans generate knowledge and meaning from their experiences. Constructivism is not a specific pedagogy, although it is often confused with constructionism, an educational theory developed by Seymour Papert. Piaget's theory of constructivist learning has had wide ranging impact on learning theories and teaching methods in education and is an underlying theme of many education reform movements.

Constructivism recognizes that students are at different levels of understanding and elicit a variety of ideas. Sharing their ideas with others allows them to clarify their own thoughts and consider those of their peers. Heterogeneous cooperative groups allow students to share ideas, reflect on the ideas of others, and debate differences in views. Students may not be thinking in the same manner, but they are learning ideas in ways that are meaningful to them (Schulte, P.L. 1996).

Besides 4E and 5E models of the constructivist approach, there is another model known as the 7E model which is much more developed than 5E model. It consists of 7 stages: to excite, explore, explain, expand, extend, exchange, examine (Çepni, Şan, Gökdele & Küçük, 2001).

The problem sentence of research is that 'Are there any meaningful differences between the 7E model and traditional model on students' success in teaching fraction concept to the fourth grade primary school students?' This study aims to investigate the effect of the 7E model on the fourth grade primary school students' comprehension skill about fraction concept.

## **2. Method**

This study is conducted at a primary school, in 2008-2009 Academic Years, in Trabzon with 44 fourth grade students.

### *2.1. Model of Research*

A quasi-experimental research design is used with an experimental and control group using the pre and posttest approach. Lesson plans based on the 7E model and the existing ones covering objectives under three standards of the fraction unit were taught in experimental and the control group. The researchers tried to find out if there is a difference between two groups concerning gaining target behaviors and providing permanence learning.

### *2.2. Data Collection Tools*

Both qualitative and quantitative data were gathered for the study. Qualitative data were collected by classroom observations and semi-structured student interviews and quantitative data were obtained by the achievement test prepared.

To see whether teaching the lessons according to the 7E model has impression on the continuance of participants' knowledge, 7 open-ended questions asked to the students and 5 open-ended questions asked to the teachers. After the study both teachers and students were also asked to write general opinion about teaching activities.

### *2.3. Data Analysis*

The data analysis obtained from the application is done in using SPSS packet program. Students' mathematics knowledge assessment over ten points is done via the pre and posttest. Their scores are compared with each other using t- test. In the process of descriptive analysis of worksheet, interviews, conceptual change texts, and reflective writings students' sentences were directed taken. Students' thoughts transferred as they are and is believed in this way the readers had opportunities to interpret the data on their own.

## 2.4. Implementation Process

At the very initial step, an achievement test was applied students. Achievement test was developed by taking opinions of experts and teachers.

There are many objectives under three standards for fraction unit at Primary School Mathematics Program (MEB, 2005). To access the gains, a worksheet prepared according to the 7E model is performed to control group during 6 class hours. During applications, a conceptual change text is used to remove the misconceptions found in the pre test. 6 hours lessons including pre and posttest, taught to the experimental and the control group. During application the experimental group was divided into two-person heterogeneous groups.

## 3. Findings

### 3.1. Findings of pre-test

When the pre-test results were examined, it was seen that students have the misunderstandings and misconceptions in below.

According to pretest findings, if multiplication of fraction denominator and share are equal to each other, students thought that fractions are equivalent to each other. A student says that  $4/10$  fraction is not equivalent of  $2/5$  fraction. While explaining this, he says it is not possible as  $4/10$  is extended fraction with 2 of  $2/5$ . That type of question which students should make addition and subtraction of two different fractions, they do not care the different fraction denominator and they make addition of denominator and shares.(e.g. addition of  $6/7 + 3/8 = ?$  But students found that result  $6/7 + 3/8 = 9/15$ ). Some students say that big fraction denominator should be written while making addition of two different denominator (e.g. addition of  $6/7 + 3/8 = ?$  but students found  $6+3 / 8 = 9/8$  ).

### 3.2. Findings of observations and interview

After examining the result of pretest, an interview is made with students in the experimental group. At the last interview, it is seen that there is a positive development in contrast with first interview.

At the end of the study, students are asked to write their opinions about the material. Some opinions belong to the students are given below.”

“Our lessons were very amusing. You taught us lots of things. You gave fractions by using potatoes and apples. Fractions seemed as if they had been alive. It was very nice.”

“That lesson was very nice. I liked working with potatoes and apples. I took potatoes and apples. They would be a good memory for me.”

### 3.3. Comparison of pre-test and post-test

Below table is the result of independent t-test and show whether there is a meaningful difference between experimental and control group.

Table-1 Experimental and Control Groups' Pretest Comparison

Pre-test	N	$\bar{x}$	S	sd	t	P
Experimental Group	22	6.81	2.19	42	-5.28	.600
Control Group	22	7.13	1.78			

There is not obvious difference at pretest results between Experimental and Control Group ( $t_{42}=-0.528$   $p>.05$ ). That can be interpreted as the groups of students are equivalent.

Table-2 Experimental and Control Groups' Post-test Comparison

Post-test	N	$\bar{X}$	S	sd	t	P
Experimental Group	22	8.45	1.56	42	2.05	.046
Control Group	22	7.36	1.94			

There is obvious difference at posttest results between Experimental and Control Group ( $t_{42}=2.052$   $p<.05$ ). Thus, the result of independent t-test shows that the difference between two groups is in favor of experimental group.

Table-3 Experimental Group Pre and Posttest Comparison

Experimental Group	N	$\bar{X}$	S	sd	t	P
Pre- test	22	6.81	2.19	21	-4.50	.000
Post-test	22	8.45	1.56			

From the result of dependent t-test, a significant difference is found in favor of posttest ( $t_{21}=-4.500$ ,  $p<.01$ ). This finding shows that the Experimental Group success has increased in the environment designed with the 7E model.

Table-4 Control Group Pre and Posttest Comparison

Control Group	N	$\bar{X}$	S	sd	t	P
Pre- test	22	7.13	1.78	21	-1.22	.234
Post-test	22	7.36	1.94			

From the result of dependency t-test, a significant difference is not found in favor of posttest ( $t_{21}=-1.226$ ,  $p>.05$ ). That finding can be interpreted as the environment designed with traditional teaching method for control group did not affect their success.

#### 4. Discussion and Results

- A significance difference is not observed among experimental and control group students' pre-test results. That is, it is determined that before the study students' level were the same both in experimental and control group.
- By the help of analysis result it is determined that experimental group students trained with the 7E model were more successful than control group. Hence; it could be argued that the 7E model is an effective teaching method.
- It is observed that the worksheets and conceptual text prepared according to the 7E model gave positive impressions to the students at the experimental group and at the same time students' misconceptions decreased and students gave better answers to the questions.
- From the result of pre and post-interview comparison it is seen that students corrected their misconceptions they had before study and they were able to answer the questions though two weeks past. We can say that materials based on the 7E model have an influence on lesson permanence.
- After study, students' comments are taken and some of them are written in the finding part. Student said that they liked the lesson, potatoes and apples activities and also mathematics lesson was entertaining them.

## 5. Recommendation

- Rudiments are very important for effective learning. 7E Model is applied step by step so that it enables to realize rudiments and misconceptions at the first step and teachers can provide opportunities to take measures according to this situation.
- To teach the lesson associating with daily life, both makes it entertaining and helps the information permanency. If the 7E Model's step consists of daily life activities, the information will be more permanent.
- Teachers should be informed about Constructivist Approach and Models and also their important parts should be stressed in detail with some concrete materials.
- Mathematics courses include abstract topics so each topic may not possible to design according to the 7E model. Also, 7E model in terms of applicability according to 4E and 5E model includes a process more difficult and longer. This can decrease the applicability of mathematics in the 7E model.
- Finally, to prepare a lesson plan according to the 7E model requires a lot of time. It may be difficult for each topic to distinguish the steps within 7E model from each other. However, that method may be suitable for science and technology lesson which has more concrete concepts.

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